

IN THE CLAIMS:

Please amend the claims as indicated below.

1 1. (Amended) A method for improving the physical and mechanical properties of ion-
2 conducting materials, comprising:

3 providing an ion conducting base material;

4 providing a crosslinking agent; and

5 incorporating the crosslinking agent into the ion-conducting base material through

6 hydroxyl and sulfonic acid condensation or ~~through~~ through amine and sulfonic acid
7 condensation.

1 2. (Previously Presented) A method as in claim 1, wherein the incorporation takes place in a
2 non-aqueous environment.

1 3. (Previously Presented) A method as in claim 1, wherein the crosslinking agent has a
2 chain that includes an aromatic polymer chain, an aliphatic polymer chain, an organic or
3 inorganic polymer network, or any combination thereof.

1 4. (Previously Presented) A method as in claim 1, wherein, in addition to one or more of
2 amine, hydroxyl, or sulfonic acid groups, the crosslinking agent has at least one functional group
3 to form a covalent crosslinking bond with the ion conducting base material.

1 5. (Previously Presented) A method as in claim 1, wherein the ion conducting base material
2 is an organically-based material, an inorganically-based material, or a composition thereof.

1 6. (Previously Presented) A method as in claim 1, wherein the ion conducting base material
2 is organically based and containing aromatic or aliphatic structure.

1 7. (Previously Presented) A method as in claim 6, wherein the aromatic structure includes
2 poly-aryl ether ketones and poly-aryl sulfones.

1 8. (Previously Presented) A method as in claim 6, wherein the aliphatic structure includes
2 perflourinated or styrene co-polymer types

1 9. (Previously Presented) A method as in claim 1, wherein the ion conducting base material
2 contains one or more inorganic additives.

1 10. (Previously Presented) A method as in claim 9, wherein the inorganic additive is
2 selected from the group consisting of clay, zeolite, hydrous oxide, and inorganic salt.

1 11. (Previously Presented) A method as in claim 10, wherein the clay includes an
2 aluminosilicate-based exchange material selected from the group consisting of montmorillonite,
3 kaolinite, vermiculite, smectite, hectorite, mica, bentonite, nontronite, beidellite, volkonskoite,
4 saponite, magadite, kanyaite, zeolite, alumina, rutile.

1 12. (Previously Presented) A method as in claim 1, wherein the ion conducting base material
2 has a given molecular weight and/or polymer structures with functional groups that include
3 sulfonic acids, phosphoric acids, carboxylic acids, imidazoles, amines, and amides.

1 13. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is
2 hydroxyl terminated and the ion conducting base material is sulfonated, and wherein the
3 incorporation includes direct covalent crosslinking between the hydroxyl terminated
4 crosslinking agent and the sulfonated ion-conducting base material such that their reaction is in
5 the form of

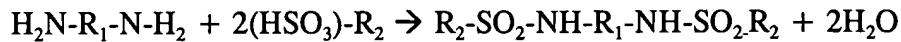


6 where R₁ is the hydroxyl terminated crosslinking agent's main chain and R₂ is the sulfonated
7 ion conducting base material.

1 14. (Previously Presented) A method as in claim 13, wherein the main chain includes one or
2 more chains selected from a group consisting of an aromatic polymer chain, an aliphatic
3 polymer chain, organic molecules and inorganic molecules.

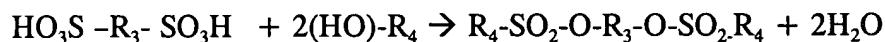
1 15. (Previously Presented) A method as in claim 13, wherein the sulfonated ion conducting
2 base material includes, one or more chains selected from a group consisting of an aromatic
3 polymer chain, an aliphatic polymer chain, organic molecules and inorganic molecules.

1 16. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is amine
2 terminated and the ion conducting base material is sulfonated, and wherein the incorporation
3 includes direct covalent crosslinking between the amine terminated crosslinking agent and the
4 sulfonated ion-conducting base material such that their reaction is in the form of

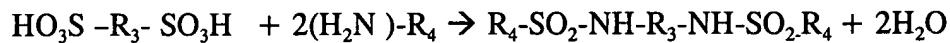


5 where R_1 is the amine terminated crosslinking agent's main chain and R_2 is the sulfonated ion
6 conducting base material.

1 17. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is sulfonic
2 acid terminated and the ion conducting base material is amine or hydroxyl terminated, and
3 wherein the incorporation includes direct covalent crosslinking between the sulfonic acid
4 terminated crosslinking agent and the amine or hydroxyl terminated base ion-conducting
5 material such that their reaction is in the respective form of



6 or



7 where R_3 is the sulfonic acid terminated crosslinking agent's main and R_4 is the amine or
8 hydroxyl terminated ion conducting base.

1 18. (Previously Presented) A method as in claim 1, wherein incorporation involves a
2 reaction solvent, including a high boiling point, non-polar solvent selected from a group
3 consisting of dimethyl sulfoxide (DMSO), n-methyl pyrrolidinone (NMP), dimethyl acetamide
4 (DMAc) and dimethylformamide (DMF).

1 19. (Previously Presented) A method as in claim 1, wherein incorporation proceeds under

2 azeotropic distillation via a removal of water by toluene to facilitate reaction kinetics.

1 20. (Previously Presented) A method as in claim 1, wherein incorporation involves 0.1% to
2 8% crosslinking agent's molar equivalents with respect to ion conducting base material's
3 sulfonic acid sites.

1 21. (Previously Presented) A method as in claim 1, wherein incorporation involves 0.1% to
2 8% crosslinking agent's molar equivalents with respect to ion conducting base material's amine
3 or hydroxyl group sites.

1 22. (Previously Presented) A method as in claim 1, wherein the ion conducting base
2 material contains an inorganic cation exchange material.

1 23. (Previously Presented) A method as in claim 22, wherein the inorganic cation exchange
2 material is selected from a group consisting of clay, zeolite, hydrous oxide, and inorganic salt.

1 24. (Previously Presented) A method as in claim 22, wherein the inorganic cation exchange
2 material further includes a silica based material and a proton conducting polymer based
3 material.

1 25. (Amended) A method for adding functionality to ion-conducting materials,
2 comprising
3 providing an ion conducting based material;
4 providing a [modified] crosslinking agent; and
5 incorporating the modified crosslinking agent into the ion-conducting base material
6 through hydroxyl and sulfonic acid condensation or ~~through~~ through amine and sulfonic acid
7 condensation.